

DOCUMENT RESUME

ED 177 471

CS 004 970

AUTHOR Schwartz, Robert M.
TITLE Levels of Processing: The Strategic Demands of Reading Comprehension. Technical Report No. 135.
INSTITUTION Bolt, Beranek and Newman, Inc., Cambridge, Mass.; Illinois Univ., Urbana. Center for the Study of Reading.
SPONS AGENCY National Inst. of Education (DHEW), Washington, D.C.
PUB DATE Aug 79
CONTRACT 400-76-0116
NOTE 45p.
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Development; Elementary Education; Higher Education; *Reading Comprehension; *Reading Processes; *Reading Research; Recall (Psychological); *Skill Development
IDENTIFIERS *Center for the Study of Reading IL; *Reading Strategies

ABSTRACT

A study was undertaken to measure the effect on reading comprehension of forcing attention to different levels of analysis. The assumption was that since texts can be analyzed at a variety of levels, comprehension requires a basic strategic coordination of processing activities. Forty second grade, fifth grade, and college students read and recalled stories under four sets of orienting instructions. These treatment conditions consisted of an intentional memory set and three secondary orienting tasks differing in the amount of semantic processing required. Adults' recall reflected the level of semantic analysis involved in the orienting task; the younger groups were only affected by the least semantic task. Beginning readers appeared to lack the processing flexibility necessary to establish goals for reading and for efficiently achieving them. (Author/MMM)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED177471

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

CENTER FOR THE STUDY OF READING

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

Technical Report No. 135

LEVELS OF PROCESSING:
THE STRATEGIC DEMANDS OF READING COMPREHENSION

Robert M. Schwartz
Oakland University

August 1979

University of Illinois
at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

Bolt Beranek and Newman Inc.
50 Moulton Street
Cambridge, Massachusetts 02138

The research reported herein was supported in part by the National Institute of Education under Contract No. US-NIE-C-400-76-0116.

Abstract

The research presented here is designed to measure the effect on reading comprehension of forcing attention to different levels of analysis. Since texts can be analyzed at a variety of levels, such as letters, spelling patterns, words, etc., comprehension requires a basic strategic coordination of processing activities. Forty second grade, fifth grade, and college students read and recalled stories under four sets of orienting instructions. These treatment conditions consisted of an intentional memory set and three secondary orienting tasks differing in the amount of semantic processing required. Adults' recall reflects the level of semantic analysis involved in the orienting task; the younger groups were only affected by the least semantic task. Beginning readers appear to lack the processing flexibility necessary to establish goals for reading and efficiently achieve them.

Levels of Processing:

The Strategic Demands of Reading Comprehension

Written text can be analyzed at a variety of conceptual levels. For example, proofreaders are required to attend to spelling patterns within words while ignoring syntactic and semantic information which might lead them to overlook typographic errors. Teachers, on the other hand, often complain that abnormalities in the syntactic pattern of their students' papers make it difficult (or impossible) to focus on the thematic content of the papers. The various levels at which text can be analyzed, and the interdependence of these codes, require a basic coordination of processing activities for reading. The orchestration of mental processing appears to be a key component in the development of memory skills (Brown, 1978a; Flavell, 1970); therefore, the purpose of this study is to explore its importance in the development of reading comprehension.

Since one of the main goals of reading is the construction of a semantically well-integrated representation of the meaning aspects of the text, the subordination of other codes to this goal is required. As the information processing system for reading develops toward fluency, there should be increased efficiency in the construction of the semantic representation. This in itself could constitute one definition of reading fluency. Secondary attentional tasks imposed during reading can effect the representation of the thematic structure in memory. The extent of the effects produced by various tasks provides a possible test of the efficiency of processing.

Attentional manipulations in reading are particularly interesting since secondary tasks can direct processing to various aspects of the written code. These smaller elements, such as features, letters, or words, appear to be logical constituents of the semantic content and are often sequenced in a type of learning hierarchy for instructional purposes. Therefore, if developmental differences exist in the information processing of beginning versus fluent readers, these differences should be reflected in memory effects of orienting tasks at various code levels.

An interactive view of information use in reading (Levy, 1977; Rumelhart, 1976) suggests that all codes can contribute to reaching a criterion decision among alternative possibilities at any one code level. In fluent reading, where attention is directed at thematic analysis, this interactive system should provide optimum efficiency for construction of a semantic representation. However, when attention at the thematic level is disrupted and criterion decisions required at other code levels, then a serial processing component is introduced. The convergence of information necessary for a decision at a constituent or lower level code will not necessarily yield sufficient information to construct an integrated semantic representation. Rather, the constituent decision must be subordinated to the goal of comprehension so that the information obtained is subsequently utilized.

This means-end subordination of processing constitutes the definition of strategic behavior (Flavell, 1970). Brown (1975, 1978a) indicates that metacognitive aspects of strategic behavior are likely to result in developmental differences on tasks requiring strategic coordination. Thus, part of

the difficulty experienced by beginners and poor readers may result from the frequent need to coordinate criterion decisions made at different code levels.

The research presented here is designed to measure the effect on reading comprehension of forcing attention to different levels of analysis. These levels represent codes available in written text and are analogous to processing involved in mediated word recognition (LaBerge & Samuels, 1974). Within an incidental learning paradigm, the shift to lower level or less semantic tasks should result in less recall (Anderson, 1970; Craik & Lockhart, 1972; LaBerge & Samuels, 1974). Reading, however, differs from the situations generally investigated under this paradigm in that component analysis constitutes an integral rather than incidental part of the task. Therefore, specific orienting tasks are introduced as secondary to a general goal of story recall. This establishes a situation in which processing induced by the orienting activity can either enhance or retard comprehension depending on its compatibility with the subject's normal processing mode and strategic ability.

Four treatment conditions are compared in the present research. The basic intentional memory set occurs in isolation as the normal reading condition, but also in combination with the remaining tasks. These latter conditions modify the text materials such that every fourth word of four or more letters becomes an operative site for the following tasks: (a) Word Choice--a pair of words is presented above and below the target site. The task requires semantic analysis of the alternatives in terms of context

to choose the appropriate words. (b) Reverse Reading--the target word is raised above the normal line of text and typed in reverse sequence beginning with the last letter of the word. This task approximates mediated word recognition in that both context and orthographic cues contribute to identification of an unfamiliar printed stimulus. (c) Letter Match--each target word is presented above a set of randomly selected letters, one to four of which also appear in the target word. The subject is to draw a line through each letter in the random set which also appears in the target word. This condition lacks the semantic component of the previous two tasks while focusing attention to the orthographic level. (See examples in Table J.)

Insert Table I about here.

The main hypothesis derived from the level-of-processing paradigm (Craik & Lockhart, 1972) suggests that the three orienting tasks will produce different levels of recall based on the amount of semantic processing induced; thus, the ordering should be: word choice > reversed word > letter match. The relationship of performance on the normal reading condition to the other orienting tasks depends on the type of processing induced by intentionality. Since fluent reading requires criterion decisions at a semantic level (LaBerge & Samuels, 1974; Rumelhart, 1976), performance of skilled readers should be similar in the intentional and word choice conditions.

For beginning readers, attentional processing is necessary at lower code levels. The necessity to coordinate information resulting from these intermediate level decisions will impose strategic demands similar to those involved in the non-semantic orienting tasks. Therefore, intentionality may fail to invoke appropriate forms of semantic processing (Murphy & Brown, 1975). Given these considerations, beginning readers should perform better in the word choice condition than under simple intentional learning instructions, since the former insures some degree of semantic processing.

Method

Design. The four treatment conditions are a within-subjects factor. The various combinations of story x treatment and trial x treatment are counterbalanced, using a Greco-Latin Square design that is replicated at each ability level--college, and grades two and five. The use of different stories with each grade prevents direct comparisons across grades and thus establishes three separate experiments. Since all other aspects are identical, these studies are reported and discussed concurrently.

In each study, retention of the task materials was the dependent measure, assessed through free recall scores. The total amount of information recalled as a function of treatment conditions was of interest, as were differences in the overall pattern of results across ability levels.

Subjects. Forty subjects from each of the three grade levels--second, fifth, and college undergraduates--participated in the study. Grade school subjects were from three elementary buildings of the local public school

district. College subjects were enrolled in sections of introductory educational psychology courses at the University of Illinois, Urbana-Champaign.

Grade school students receiving remedial instruction in reading were eliminated from the subject pool, with further screening of subjects conducted through a pre-test on vocabulary recognition. Two subjects who failed to qualify on this vocabulary criterion were eliminated from the testing sample.

Materials. The materials for this experiment consisted of stories at each grade level, a recognition test comprised of single words sampled from the story vocabularies, and random digit sets for use in a distractor task. Of these items, the stories and their variations for different treatment conditions are the most crucial elements. Three sets of five passages were selected from comprehension tests, instructional materials, and research protocols designed for use with the appropriate grade subjects. Story selection was limited to sequential narratives rather than descriptive or topical, factual accounts, since the pilot data on the three types of passages indicated that recall of the latter two forms was relatively low.

Four stories from each set were designated as target passages for use in combination with the treatment conditions. The remaining story was tape-recorded for use in an aural practice trial. The target passages varied in length, both within and between grade levels, ranging from 65 to 67, 92 to 100, and 97 to 115 words for second, fifth, and college levels, respectively.

A separate study (Schwartz, 1978) was conducted to determine an idea unit structure for these stories against which subjects' recall protocols could be scored. In that study, two segmentation procedures were contrasted, that of Johnson's (1970) pausal units and a modification of Spencer's (1974) functional units. Both procedures yielded an idea structure that was highly replicable across groups. The functional unit segmentation is utilized in this study since it resulted in approximately twice as many scoring units in the idea structure as Johnson's procedure. These smaller units should enable a more precise scoring, requiring less inferencing by scorers in judging whether a given idea unit is represented in a subject's recall. Some additional support for this decision and validation of the functional units is provided by the fact that 88% of the terminal words identified in the pausal system also constitute terminal words in the functional segmentation. The final idea structure for the passages varied in the number of units identified both within and across grades. These range from 16 to 18, 21 to 39, and 21 to 35 for second, fifth grade, and college levels, respectively.

Treatment conditions were embedded within stories by designating specific target words in each passage as operative sites. Every fourth word or four or more letters served as a target site for the three secondary orienting tasks. Proper names were included in the spacing of target words but could not in themselves serve as targets. The final operative site in a passage had to precede one spacing unit of four-letter words.

This last requirement allowed subjects to rapidly conclude the passage and thus terminate the exposure period.

In the Normal Reading condition, no modification of target sites occurred; the passage was centered on the page with four spacing units between lines. In the other three conditions, the same arrangement was used, with target words replaced by underlining in the appropriate position.

The Word Choice condition was created by printing the target word and a distractor word above and below the target site. Distractors were syntactically compatible, but semantically unacceptable, within the context of the story. The positional placement of these alternatives above or below the site was randomly decided for each pair.

For the Reversed Reading condition, the appropriate target word, printed above the target position in a reversed sequence, began with the last letter of the word and ended in the right-most position with the first letter of the word. The final orienting condition, Letter Matching, was produced by printing the target word a line above its site and an equal number of randomly arranged letters below the line, one to four of which were also in the target word. Examples of these formats are presented in Table 1.

The word recognition tests were based on a set of twenty words sampled from the second or fifth grade passages, respectively, the samples restricted to non-target words of four or more letters. These items were then typed on 3 x 5 cards, one word per card.

Each of five sets of random digits, selected for use as an interpolated task between passage presentation and recall, consisted of three separate strings of four, five, and six digits, respectively. The last digit of each string was omitted in use with second and fifth grade subjects, yielding trials of three, four, and five digits.

Procedure. Subjects were tested individually in sessions lasting approximately one-half hour. Each testing session consisted of five recall segments, one aural practice trial, and the four treatment conditions. The sequence of events within a segment was: orienting instructions for the treatment condition, presentation of the story, reversed digit span task, and free recall. The isolated word recognition test was administered prior to introduction of the experimental tasks. Each of the twenty words from the appropriate grade sample were shown briefly (approximately a two-second presentation). Students mispronouncing more than two items were eliminated from the sample and excused from the testing session after a brief exposure to the treatment materials.

The study was introduced as a developmental investigation of reading skills, using subjects from the three grade levels. It was explained that there would be a number of different segments; the sequence of events was subsequently described, followed by a more detailed explanation of the reverse digit span task and the recall instructions, stressing the need for recall of all ideas from the story. Subjects were instructed to retell the story as completely as possible using their own words, or phrases from the story itself.

Participants were then told that there would first be a warm-up trial on which to practice the different steps in the procedure. For this, the practice story was recorded on tape; subjects were instructed to listen carefully so that they could retell the story later. They were also informed that there would be some time (fifteen seconds) between the end of the story and the digit task; they were to use this time to think about what happened in the passage.

The reversed digit span task was used as an interpolated task between story presentation and recall to disrupt rehearsal of the stories' surface structure. The subjects listened to a string of digits and then attempted to repeat them in reverse order. Following each story, subjects heard three digit strings of different lengths, increasing by one digit per string. They attempted to repeat the numbers in reverse order immediately after having heard each string. For second and fifth grade subjects, the first string was three digits, while college subjects began with four digits.

Story recall began immediately after the third digit set. Subjects were allowed as much time as they needed to recall the story. When it appeared that they had completed their statements, the experimenter prompted them twice with the following statement: "See if you can remember anything else about the story." (Pause to let the child respond.) "Can you think of anything else about the story?"

Subjects were assigned to one of four treatment sets as they entered the study. These sets counterbalanced the sequence of treatment and story x treatment combinations. Prior to each recall segment, the experimenter

presented orienting instructions for the appropriate condition. When a secondary orienting task was involved, subjects were shown a sentence with two target sites and asked to perform the secondary task; corrective feedback was given, if necessary.

Just prior to presentation of the target story, subjects were again reminded that they would have to retell the story later; participants read each story orally, pausing when necessary to perform the secondary task. The experimenter corrected misreadings or incorrect responses. Upon completion of the story the text was removed, and the remainder of the segment completed as described above.

Results

Two parallel sets of analyses were conducted. The first set deals with recall at the level of ideas expressed in the stories, while the second examines recall of individual words that comprise the target sites of the secondary orienting tasks. Both levels of analysis explore the effects of the orienting instructions on recall.

Idea Units

Idea unit scores were obtained by comparing subjects' free recall protocols to a pre-established idea structure for each passage. A rater judged whether or not each unit in the idea structure appeared in the subject's protocol; any approximation of a unit was accepted. A second rater scored a random sample of 20% of the subjects at each grade level.

A correlation of the scores assigned to each story in this sample yielded an interrater reliability of .87.

The main issue of the analysis was the pattern of scores obtained across treatment conditions--Normal Reading, Word Choice, Reversed Reading, and Letter Match. The means and standard deviations for these conditions at each grade level are shown in Table 2. The left half of Figures 1 to 3 graphically present these patterns of results across tasks for college, fifth, and second grade groups, respectively.

Insert Table 2 and Figures 1 to 3 about here.

An analysis of variance based on the Greco-Latin square design (Winer, 1962) was conducted at each grade level. The analyses included the four levels of treatments, stories and trials (first to fourth) as within-subjects variation and also the between-groups effect. Only for college subjects did any of these interaction effects approach significance, with a residual within-subjects value of $F(3,108) = 2.7, p < .10$.

At each grade level there was a significant treatment effect, $p < .001$, and $F(3,108)$ values of 15.0, 6.2, and 7.4 for college, fifth, and second grades, respectively. There were also significant variations in story difficulty, $p < .001$, $F(3,108) = 20.1, 26.0, 32.7$, using the same sequence of grades. The trial effect was significant for second grade and college subjects with $F(3,108) = 4.3, p < .01$, and $F(3,108) = 9.4, p < .001$, respectively, and reflects increased recall in later trials. The means for trials (first to fourth) were 8.4, 9.1, 9.5, 10.0 and 5.8, 8.0, 8.4, 8.8 for second grade and college subjects, respectively.

The means of the four treatment conditions shown in Table 2 were subjected to Newman-Keuls tests. Results indicated that for college subjects the means were ranked as follows: normal reading > reversed reading > letter match, $p < .05$. The word choice scores fall between the means for normal and reversed reading but do not differ significantly from either.

For both fifth and second grade subjects the only significant treatment effect occurred between the letter match group and the other three conditions, the letter match task resulting in less idea unit recall.

The contrasts which proved significant at the .05 level are indicated above the graphs on the left side of Figures 1 to 3. Treatments underlined by a common line do not differ from each other; treatments not underlined by a common line do differ.

Target Words

To further investigate the effects of different orienting instructions, the subjects' recall data were rescored in order to obtain a count of the number of target words which were utilized in retelling the story. Credit was given for variations on the target words, such as pluralization or verb tense change.

As in the idea unit analysis, the primary concern was the pattern of results across treatment conditions. The focus on target words should reflect local effects of treatment conditions similar to word memory results in the level of processing literature (Craik & Tulving, 1975). The means and standard deviations of the number of target words recalled are presented by grade level and treatment condition in Table 3. The right half of

Figures 1 to 3 illustrate the pattern of means across tasks for college, fifth, and second grade groups, respectively.

Insert Table 3 about here.

As in the previous analysis, there are no significant interaction effects. Story variation is significant at each grade level, $p < .001$, and $F(3,108) = 30.8, 10.7, 22.0$, for college, fifth, and second grades, respectively. For second grade subjects there is a strong effect due to trials, $F(3,108) = 5.55, p < .001$. The means per trial are 3.0, 3.6, 4.0, and 3.8 for trials 1 to 4 respectively. Similarly, for college subjects the trials effect is significant, $F(3,108) = 4.09, p < .01$; the means per trial were 3.4, 3.4, 4.4, and 3.6, respectively for trials 1 to 4. The treatment effects are significant for each grade level with $p < .005$ and $F(3,108) = 15.9, 6.2, \text{ and } 4.6$ for college, fifth, and second grades, respectively.

The Newman-Keuls procedure was used to test for significant differences in treatment means. For college students the pattern of results was word choice = reversed reading > normal reading > letter match, $p < .05$. That is, relative to the normal reading condition, where the target words receive no special emphasis, subjects recall more of these words in the tasks which center on the words and fewer when focusing on the letters of the word.

For fifth grade subjects only the word choice condition exceeds scores from normal reading. Both the word choice and the reversed reading condition exceed the letter match task; normal reading does not.

For second grade subjects none of the treatment conditions differs significantly from normal reading; however, scores on the reversed reading and word choice tasks do exceed those from the letter match task, $p < .05$.

Again, the contrasts which proved significant at the .05 level are indicated above the graphs on the right side of Figures 1 to 3. Treatments underlined by a common line do not differ from each other; treatments not underlined by a common line do differ.

Discussion

The present experiment showed that for adult fluent readers--and to a lesser extent, for children--attentional orienting tasks affect the amount and type of information recalled from reading a paragraph. In order to interpret these findings, the results will be discussed in terms of the levels-of-processing conceptual framework and issues related to the development of strategic behavior. A summary section will reconsider the initial speculation about models of reading fluency and suggest implications for instruction geared toward the development of fluent processing.

Levels of Processing

The orienting tasks have their clearest effect on recall by fluent adult readers. As shown in Figure 1, a college subject's idea unit recall tends to vary as a function of the treatment condition. The treatments differ both in the level at which criterion decisions are required and the extent of semantic analysis involved in the decision. While these two factors are closely related, they are not identical. The criterion level

represents the application of attentional processing to reach a decision at a particular code level. Semantic processing generates one source of information that may contribute to the criterion decision.

Both the word choice and the reversed reading tasks require criterion decisions at the word level; however, they differ to the extent that the decisions depend on semantic analysis. The word choice task presents two relatively familiar, and therefore easily decodable words, with the selection of the appropriate item solely dependent on semantic, top-down processing of the words in context. The reversed reading manipulation is similar to the recognition of an unfamiliar word in context. Cues are available from the previous semantic and syntactic information, with the reversal of letter sequence creating a more difficult orthographic analysis. Different combinations of top-down and bottom-up information can produce an appropriate decision, but overall, this condition is less dependent on semantic information than is the word choice decision.

For adults, this difference in the extent of semantic analysis involved in word level decisions results in a slightly better (though not statistically significant) idea unit recall for the word choice task. This difference is also reflected in the fact that the normal reading condition resulted in significantly better ($p < .05$) idea unit recall than the reversed reading task, but was statistically equivalent to word choice performance on this measure.

The superiority of idea unit recall by adults in the normal reading format is attributed to processing centered on criterion decisions at a thematic level. That is, processing of letters, words, and phrases are subordinate to decisions related to idea structure of the passage. While this optimum mode of processing may be somewhat hampered by competing attentional demands within the experiment (e.g., articulation required for oral reading), the absence of secondary orienting activities should facilitate this type of semantic analysis. It is likely that different types of semantic processing can constitute the criterion decision at this level. Imagery, elaboration, and inferencing are some of the possible candidates, but the current research provides no way of distinguishing among them. Thieman (1976) demonstrates that such distinctions at the semantic level can affect memory for lexical items.

If the difference between criterion decisions at the word level and those at the thematic level were only a quantitative shift in the amount of semantic analysis, then it would not be necessary to differentiate criterion levels. However, the results of the target word analysis suggest a qualitative difference in the recalls resulting from the initial orientation (Figure 1).

In retelling the stories, adults mention significantly more target words when the initial processing was under word choice or reversed reading conditions than the normal reading mode. Subjects were not specifically asked to recall the target word, but rather to use words or phrases from the story when possible in retelling the ideas from the story. Thus,

the greater use of target words when criterion decisions were made at the word level suggests that these words form a type of scaffolding about which the idea structure is formed. This interpretation is consistent with the view expressed by Soviet psychologists--that the head remembers what the head does (Meacham, 1972; Brown, 1978b). The use of contextual information to make word decisions creates an incidental semantic representation of the text.

This effect is not due simply to the highlighting of target words by the orienting task, since the letter match condition attenuates both idea unit and target word recall. The criterion decisions at the orthographic level required in this task apparently disrupt processing of the idea structure. Whether or not the orthographic analysis yields a strong memory trace for the target words, these words were not included in the subjects' recall. This suggests that they were not integrated with a representation of thematic information. To summarize: for adult fluent readers, recall depends both on the level at which criterion decisions are made while processing text, and the contribution of semantic processing to that criterion decision.

For younger subjects, the pattern of results across orienting tasks is less differentiated. The only difference in idea unit recall results from the disruption caused by the letter match task. This shift to criterion decisions at the letter level interferes with processing of thematic information as it did for college subjects.

It was initially hypothesized that for the youngest group, the word choice task would induce greater semantic analysis than they typically

engage in during normal reading. The expected increase in idea unit recall, however, was not obtained. Instead, it appears that these beginning readers normally function in a manner similar to that induced by the word choice and reversed reading conditions. In other words, they focus attention on making word level decisions. This orientation toward the word level does not mean that children are insensitive to syntactic or semantic information. Several studies have indicated that these code levels are used in reaching word recognition decisions (Klein, Klein, & Bertino, 1974; Neville & Pugh, 1976; Weber, 1970). The critical difference between beginning and fluent readers appears to be the level at which criterion decisions are focused.

This difference is further illustrated by the target word analysis. As shown in Figure 3, the second grade subjects do not mention significantly more target words in recall under word choice or reversed reading orientations than in the normal reading condition. While the subjects are able to make the appropriate responses to the orienting task, it does not appear that the target words represent sites for any type of unique processing. For adults, the word level decisions enhance recall of these items; for second graders, the processing of each word (or many of the words) requires similar use of information to make word decisions, so no local facilitation of target word recall is obtained. Fifth grade subjects show signs of a transition toward adult patterns of performance. For them, the word choice task resulted in greater target word recall than in the normal reading condition.

As reading skill develops, the processing of written codes should become more differentiated, thus allowing the criterion focus to be established at the thematic level. As hypothesized for adults on the word level tasks, younger subjects' idea level representations of the stories are an incidental outcome of using contextual information to make word recognition decisions. This type of incidental representation may be sufficient for comprehension of simple stories that match well with the reader's knowledge of the world (Stein & Glenn, 1978), but for more complex or unfamiliar material, strategic elaboration of the idea unit structure may become more important.

Implications for Instructional Issues

The debate over bottom-up versus top-down models of information processing in reading has generally been conceded to an interactive view. Rumelhart's (1976) model provides a nice illustration of what this interactive process might involve in fluent reading. Independent knowledge sources operate in parallel on the various information codes available in written text. The intermediate results of these analyses are coordinated by a central decision processor which evaluates the probability of incoming hypotheses and provides feedback which directs further processing.

The major instructional issues raised by this description are: (a) how would one foster the development of an interactive system, and (b) what factors can account for the variations in performance that are observed among students? While these are extremely complex questions, the perspective

derived from the current research attempts to address these issues. The illustration that differences exist in the level at which interactive processing can occur suggests that intermediate levels of instruction might foster the coordination of information around different criterion levels. Indeed, the interactive use of information at the word level appears to be a major objective of many primary level basal programs. For example, in the third grade workbook accompanying the Houghton-Mifflin reading series (Durr, LePere, & Brown, 1974), 44% of the exercises deal specifically with word level decisions, while only 26% require criterion decisions about larger units.

What appears to be necessary are more and better techniques for inducing students to subordinate word level decisions to meaning acquisition. Again, this is where the level-of-processing concepts intersect issues arising from the consideration of strategic behavior. In a report of interview data concerning the goal of school-related reading, Canney & Winograd (1979) indicated that a sizeable proportion of poor readers from second to eighth grades, in contrast with above average readers, did not conceptualize reading in terms of meaning acquisition; rather, they focused on lower level constituent codes, mainly word recognition. This lack of metacognitive awareness of the goal of reading would prevent any movement interactive processing at a thematic level.

This issue is closely related to the skill hierarchy approach to reading instruction. To the extent that the subskill becomes the criterion focus for attention, it will distract from comprehension; this is

demonstrated by the adult subjects' performance in the reversed reading and letter match conditions. To promote integration of the subskill with existing comprehension processes, it should be introduced in the context of a meaningful activity (Meacham, 1972; Brown, 1978b). Furthermore, it would be advantageous to utilize content materials from an area in which the student is familiar. By working on skill development in individually-selected content fields, one can insure that students have top-down strategies available and thus will be better able to subordinate lower level criterion decisions to meaning. Practice in this type of situation should most rapidly integrate subskills into the interactive system which defines reading fluency.

It is premature to elaborate instructional procedures based on present perspectives concerned with the development of reading fluency. However, the issue is clearly relevant to instructional practices and therefore further research in this area is warranted.

References

- Anderson, R. C. Control of student mediating processes during verbal learning and instruction. Review of Educational Research, 1970, 40, 349-369.
- Brown, A. L. The development of memory: Knowing, knowing about knowing, and knowing how to know. In H. W. Reese (Ed.), Advances in child development and behavior (Vol. 10). New York: Academic Press, 1975. Pp. 103-152.
- Brown, A. L. Knowing when, where, and how to remember: A problem of metacognition. In R. Glaser (Ed.), Advances in instructional psychology. Hillsdale, N.J.: Erlbaum, 1978. (a)
- Brown, A. L. Theories of memory and the problems of development: Activity, growth, and knowledge. In F. I. M. Craik & L. Cermak (Eds.), Levels of processing and memory. Hillsdale, N.J.: Erlbaum, 1978. (b)
- Canney, G., & Winograd, P. Schemata for reading and reading comprehension performance (Tech. Rep. No. 120). Urbana: University of Illinois, Center for the Study of Reading, April 1979.
- Craik, F. I. M., & Lockhart, R. S. Levels of processing: A framework for memory research. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 671-684.
- Craik, F. I. M., & Tulving, E. Depth of processing and the retention of words in episode memory. Journal of Experimental Psychology, 1975, 104, 268-294.

Durr, W. K., LePere, J. M., & Brown, R. Workbook for Panorama and Fiesta.

Boston: Houghton-Mifflin, 1974.

Flavell, J. H. Developmental studies of mediated memory. In H. W. Reese

& L. P. Lipsett (Eds.), Advances in child development and behavior

(Vol. 5). New York: Academic Press, 1970.

Johnson, R. E. Recall of prose as a function of the structural importance

of the linguistic units. Journal of Verbal Learning and Verbal

Behavior, 1970, 9, 12-20.

Klein, H. A., Klein, G. A., & Bertino, M. Utilization of context for word

identification decisions in children. Journal of Experimental Child

Psychology, 1974, 17, 79-86.

LaBerge, D., & Samuels, S. J. Toward a theory of automatic information

processing in reading. Cognitive Psychology, 1974, 65, 19-24.

Levy, B. A. Reading: Speech and meaning processes. Journal of Verbal

Learning and Verbal Behavior, 1977, 16, 623-638.

Meacham, J. A. The development of memory abilities in the individual and

society. Human Development, 1972, 15, 205-228.

Murphy, M. D., & Brown, A. L. Incidental learning in preschool children

as a function of level of cognitive analysis. Journal of Experimental

Child Psychology, 1975, 19, 509-523.

Neville, M. H., & Pugh, A. K. Context in reading and listening: Variations

in approach to cloze tasks. Reading Research Quarterly, 1976, 12, 13-31.

Rumelhart, D. E. Toward an interactive model of reading. In S. Dornic

(Ed.), Attention and performance VI. New York: Academic Press, 1976.

Schwartz, R. M. Strategic processing in beginning reading: A developmental view. (Doctoral Dissertation, University of Illinois, 1978). Dissertation Abstracts International, 1978, 39, 2844A. (University Microfilms No. 7821241).

Spencer, N. J. Changes in representation and memory of prose. (Doctoral Dissertation, Pennsylvania State University, 1973). Dissertation Abstracts International, 1974, 35, 558B. (University Microfilms No. 7416085).

Stein, N. L., & Glenn, C. G. An analysis of story comprehension in elementary school children. In R. Freedle (Ed.), Discourse processing: Multidisciplinary perspectives. Hillsdale, N.J.: Ablex, 1978.

Thieman, T. J. What's so deep processing: A critical analysis of the relation between incidental orienting tasks and retention. Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign, 1976.

Weber, R. M. First graders' use of grammatical context in reading. In H. Levin & J. P. Williams (Eds.), Basic studies on reading. New York: Basic Books, 1970. Pp. 147-163.

Winer, B. J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.

Table 1

Form of Orienting Tasks

Example from one sentence in a fifth grade story:

Normal Reading

The long day without rest and the running after the deer was too much for Warner's strength.

Word Choice

The long day without rest and the running after the deer was too much for Warner's clothes strength.

Reverse Reading

The gnol day without rest and the running retfa the deer was too much for Warner's htgnerts.

Letter Match

The long day without rest and the running after the deer was too much for Warner's strength.

Table 2

Means and Standard Deviations of Number of Idea Units Recalled

Group		Treatments			
		Normal Reading	Word Choice	Reversed	Letter Match
Second	<u>M</u>	10.2	9.5	9.4	8.0
	<u>SD</u>	4.2	2.8	3.4	3.7
Fifth	<u>M</u>	11.8	11.3	11.3	9.4
	<u>SD</u>	4.3	4.6	4.2	4.7
College	<u>M</u>	9.6	8.5	7.4	5.6
	<u>SD</u>	4.1	4.4	4.6	4.0

Table 3
Means and Standard Deviations of Target Words Recalled

Grade	Treatments			
		Normal Reading	Word Choice	Reversed Letter Match
Second	<u>M</u>	3.5	3.8	4.0
	<u>SD</u>	1.9	1.2	1.9
Fifth	<u>M</u>	4.8	5.6	5.0
	<u>SD</u>	2.0	2.1	1.7
College	<u>M</u>	3.4	4.8	4.2
	<u>SD</u>	2.3	2.8	2.2

Figure Captions

Figure 1. Recall as a function of orienting task: college subjects.

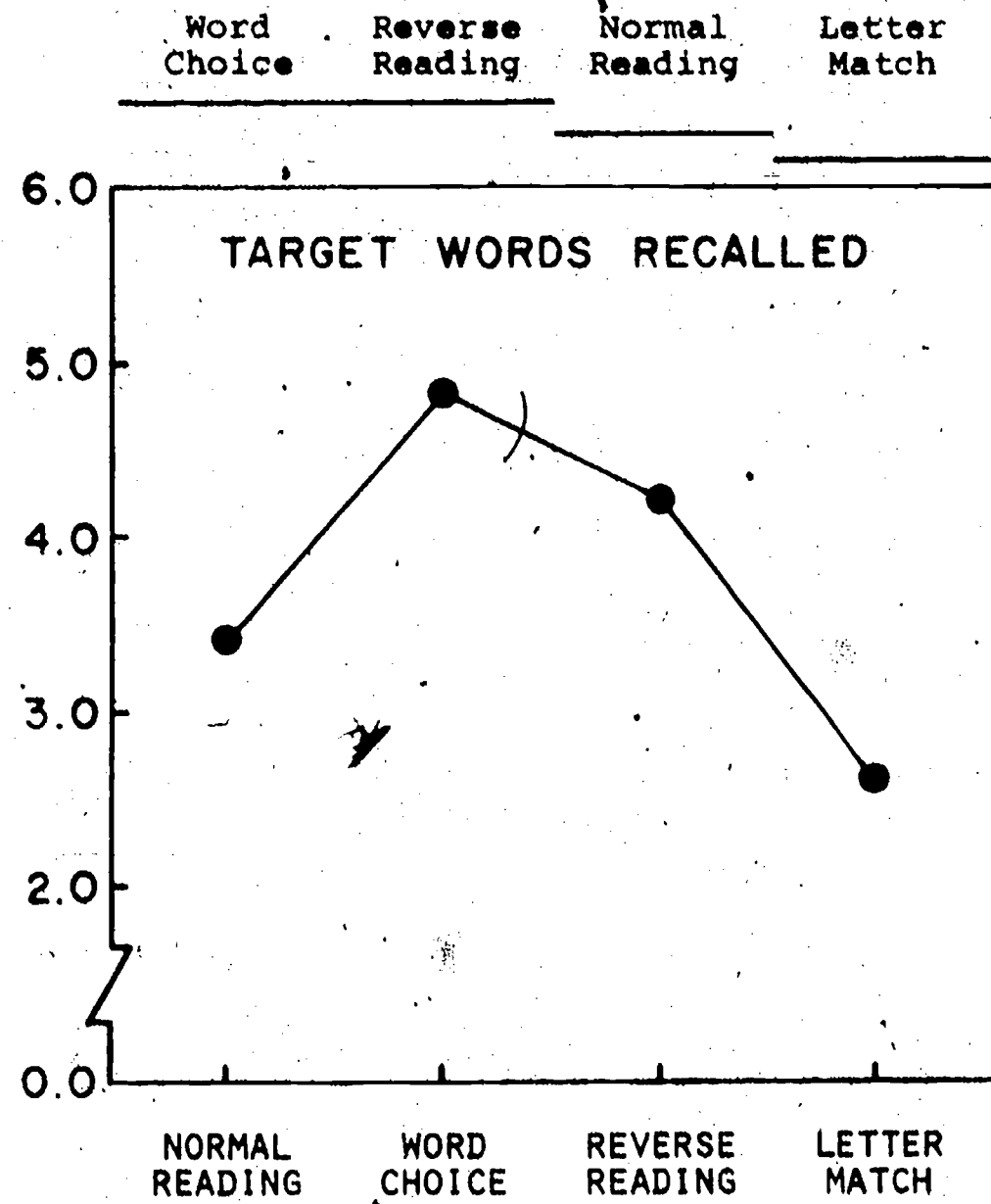
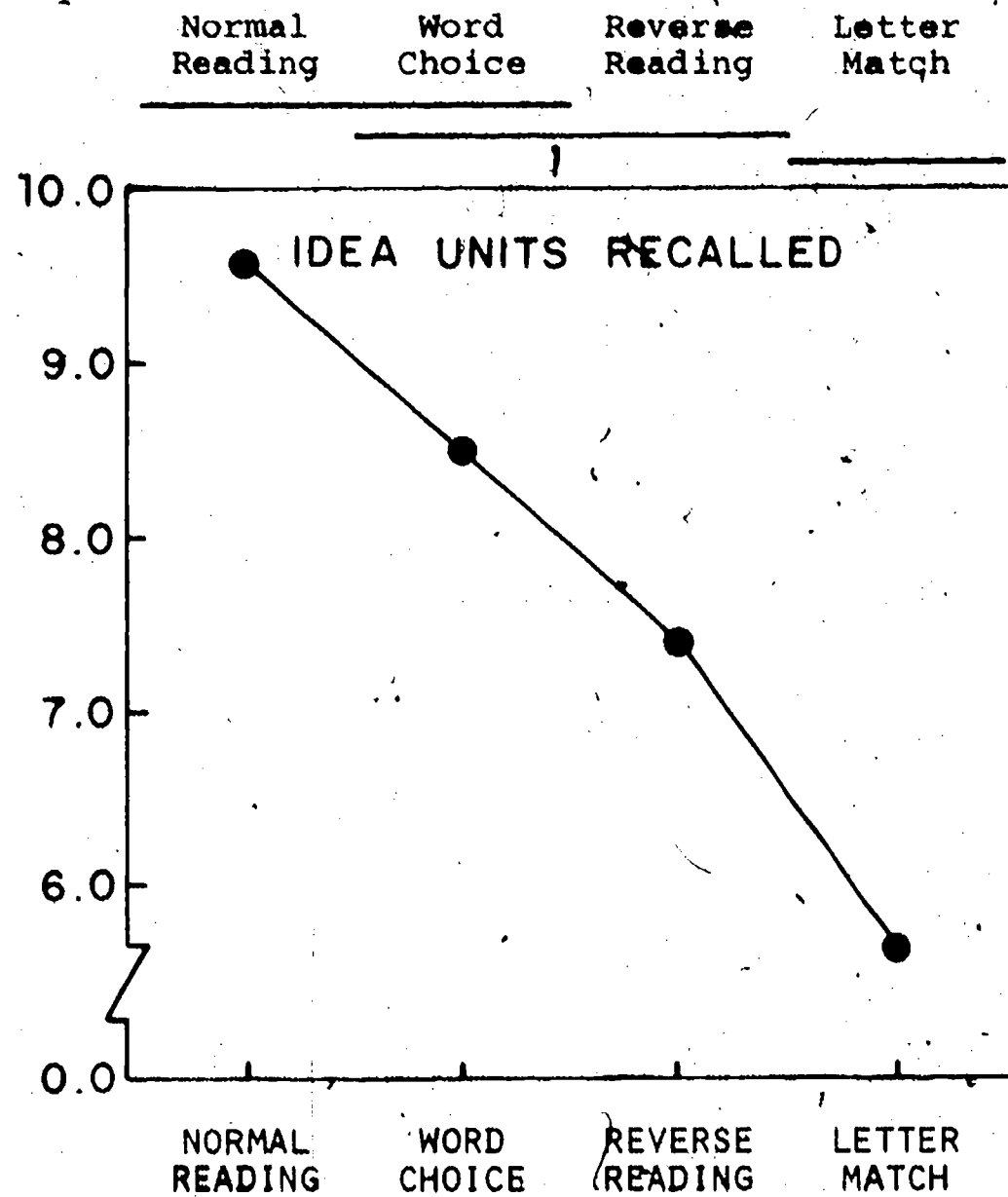
(Treatments above graphs underlined by a common line do not differ from each other; treatments not underlined by a common line do differ, $p < .05$.)

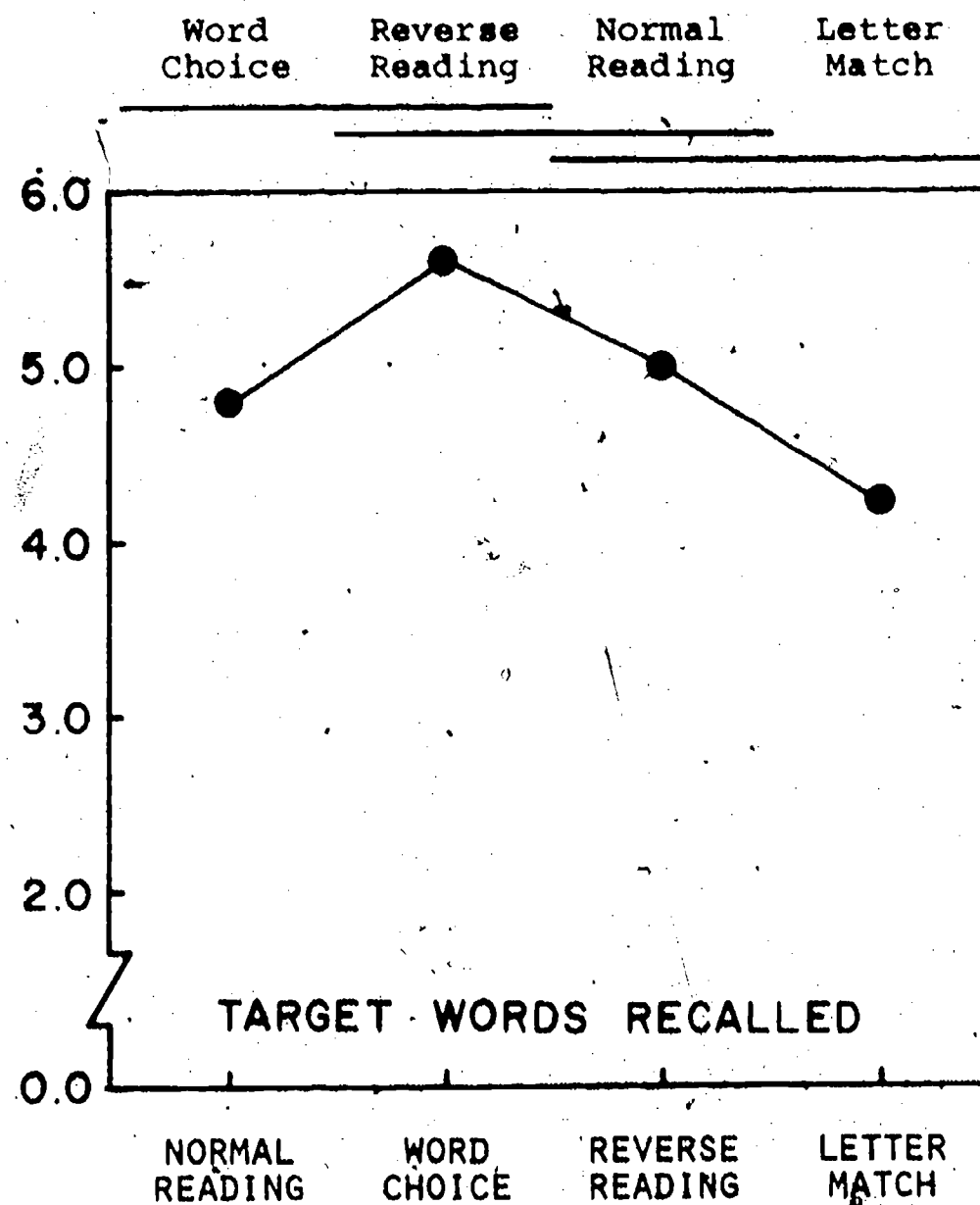
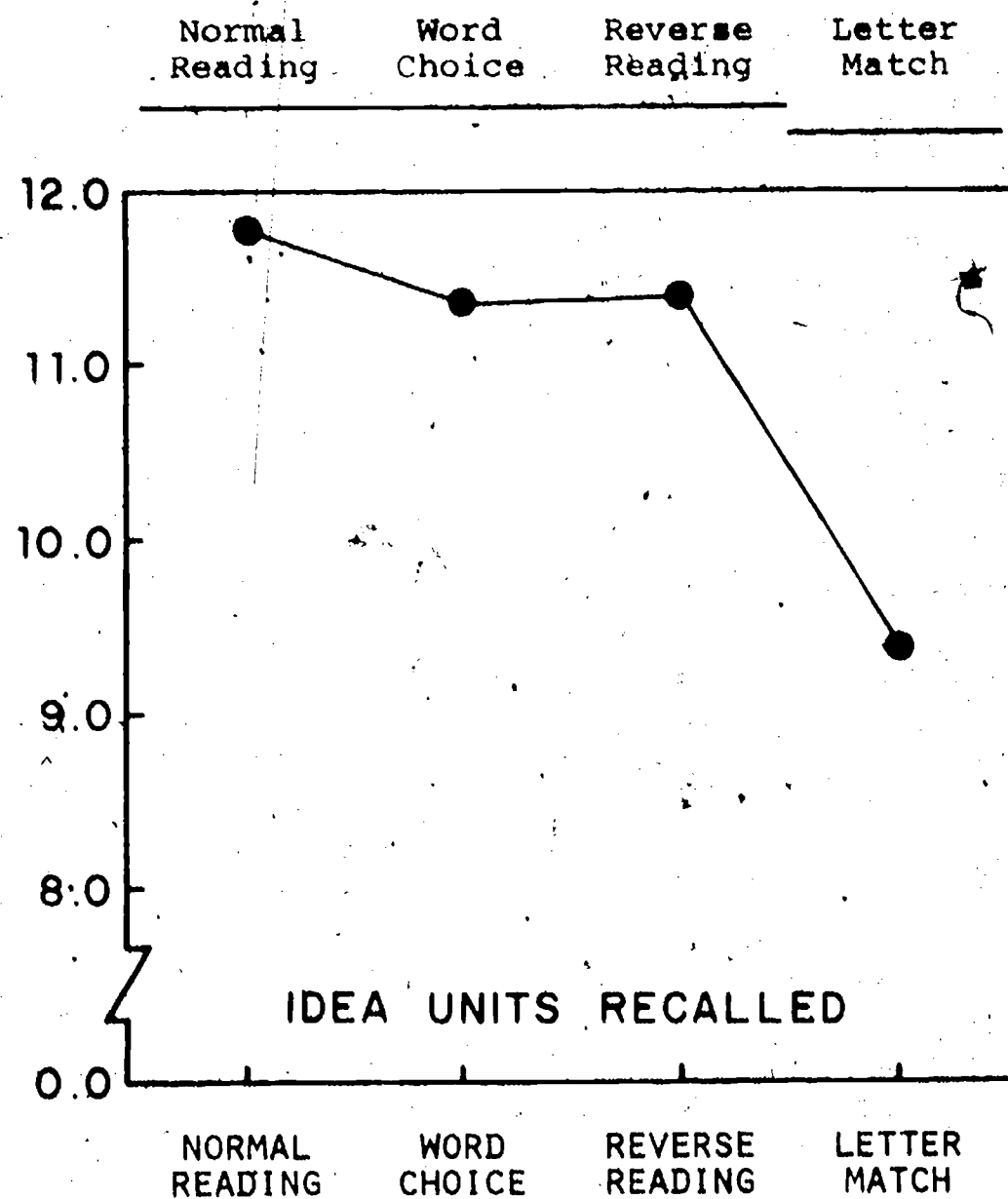
Figure 2. Recall as a function of orienting task: fifth grade subjects.

(Treatments above graphs underlined by a common line do not differ from each other; treatments not underlined by a common line do differ, $p < .05$.)

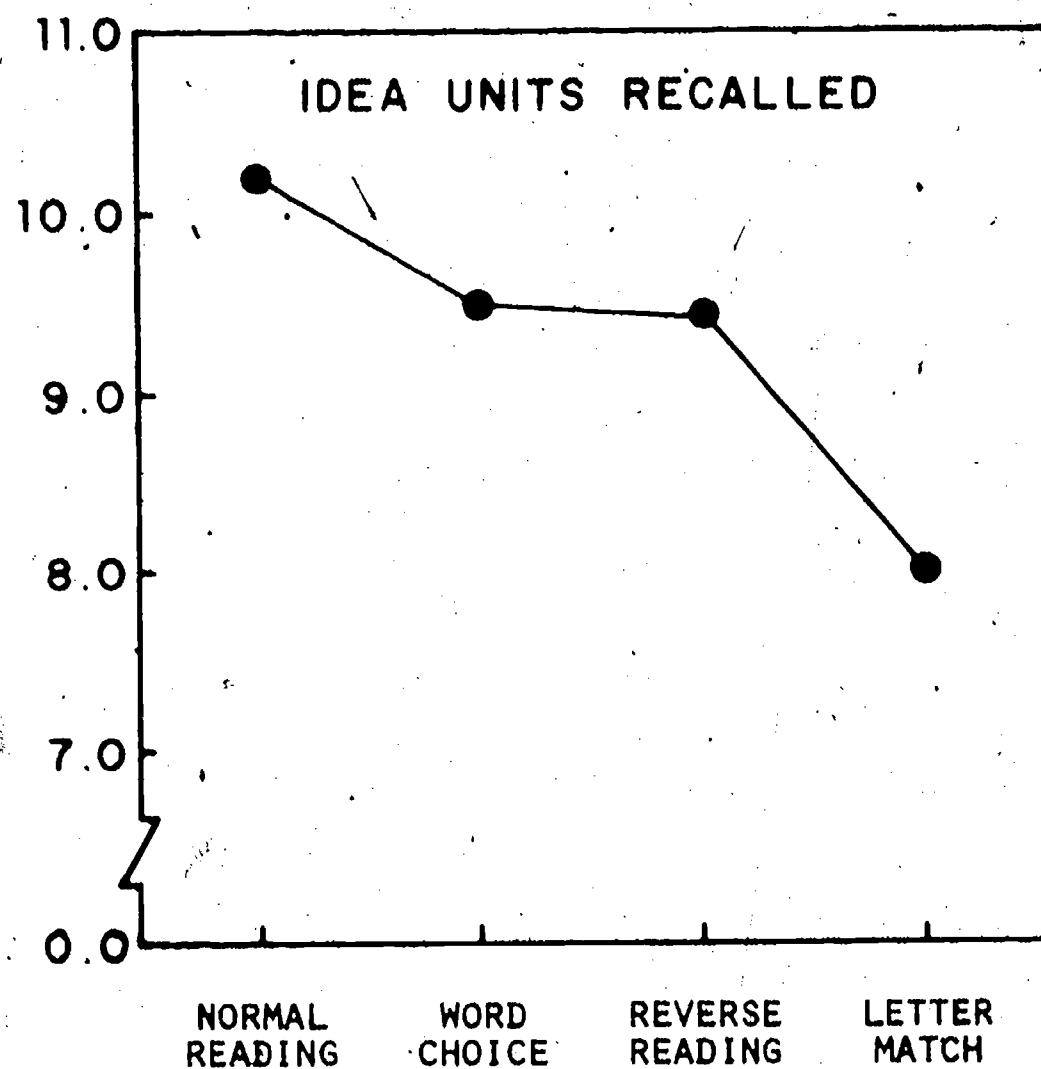
Figure 3. Recall as a function of orienting task: second grade subjects.

(Treatments above graphs underlined by a common line do not differ from each other; treatments not underlined by a common line do differ, $p < .05$.)

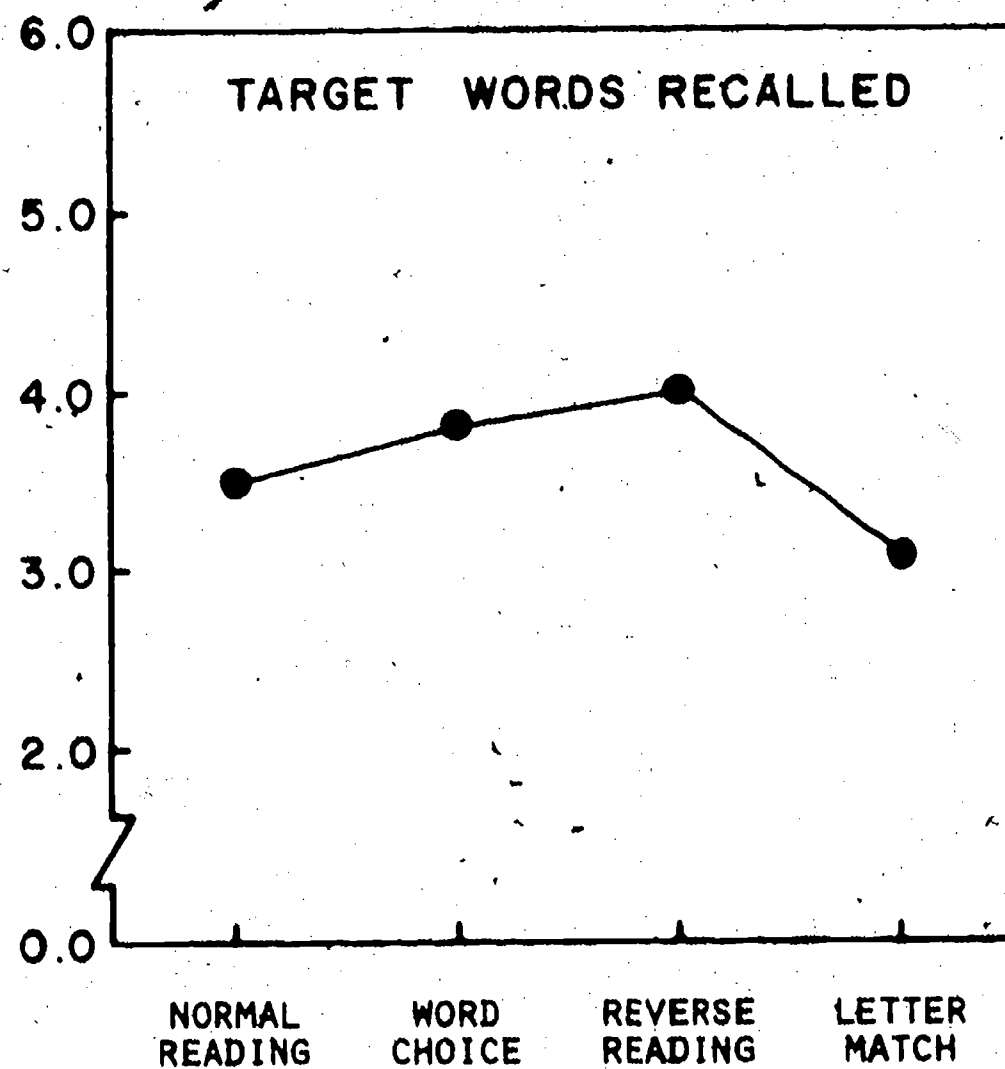




Normal Reading Word Choice Reverse Reading Letter Match



Reverse Reading Word Choice Normal Reading Letter Match



CENTER FOR THE STUDY OF READING

READING EDUCATION REPORTS

- No. 1: Durkin, D. *Comprehension Instruction—Where are You?*, October 1977. (ERIC Document Reproduction Service No. ED 146 566, 14p., PC-\$1.82, MF-\$83)
- No. 2: Asher, S. R. *Sex Differences in Reading Achievement*, October 1977. (ERIC Document Reproduction Service No. ED 145 567, 30p., PC-\$3.32, MF-\$83)
- No. 3: Adams, M. J., Anderson, R. C., & Durkin, D. *Beginning Reading: Theory and Practice*, November 1977. (ERIC Document Reproduction Service No. ED 151 722, 15p., PC-\$1.82, MF-\$83)
- No. 4: Jenkins, J. R., & Pany, D. *Teaching Reading Comprehension in the Middle Grades*, January 1978. (ERIC Document Reproduction Service No. ED 151 756, 36p., PC-\$3.32, MF-\$83)
- No. 5: Bruce, B. *What Makes a Good Story?*, June 1978. (ERIC Document Reproduction Service No. ED 158 222, 16p., PC-\$1.82, MF-\$83)
- No. 6: Anderson, T. H. *Another Look at the Self-Questioning Study Technique*, September 1978. (ERIC Document Reproduction Service No. ED 163 441, 19p., PC-\$1.82, MF-\$83)
- No. 7: Pearson, P. D., & Kamil, M. L. *Basic Processes and Instructional Practices in Teaching Reading*, December 1978. (ERIC Document Reproduction Service No. ED 165 118, 29p., PC-\$3.32, MF-\$83)
- No. 8: Collins, A., & Haviland, S. E. *Children's Reading Problems*, June 1979.
- No. 9: Schallert, D. L., & Kleiman, G. M. *Some Reasons Why Teachers are Easier to Understand than Textbooks*, June 1979.
- No. 10: Baker, L. *Do I Understand or Do I not Understand: That is the Question*, July 1979.
- No. 11: Anderson, R. C., & Freebody, P. *Vocabulary Knowledge and Reading*, August 1979.

CENTER FOR THE STUDY OF READING

TECHNICAL REPORTS

- No. 1. Halff, H. M. *Graphical Evaluation of Hierarchical Clustering Schemes*, October 1975. (ERIC Document Reproduction Service No. ED 134 926, 11p., PC \$1.82, MF \$.83)
- No. 2. Spiro, R. J. *Inferential Reconstruction in Memory for Connected Discourse*, October 1975. (ERIC Document Reproduction Service No. ED 136 187, 81p., PC \$6.32, MF \$.83)
- No. 3. Goetz, E. T. *Sentences in Lists and in Connected Discourse*, November 1975. (ERIC Document Reproduction Service No. ED 134 927, 75p., PC \$4.82, MF \$.83)
- No. 4. Alessi, S. M.; Anderson, T. H., & Biddle, W. B. *Hardware and Software Considerations in Computer Based Course Management*, November 1975. (ERIC Document Reproduction Service No. ED 134 928, 21p., PC \$1.82, MF \$.83)
- No. 5. Schallert, D. L. *Improving Memory for Prose: The Relationship between Depth of Processing and Context*, November 1975. (ERIC Document Reproduction Service No. ED 134 929, 37p., PC \$3.32, MF \$.83)
- No. 6. Anderson, R. C., Goetz, E. T., Pichert, J. W., & Halff, H. M. *Two Faces of the Conceptual Page Hypothesis*, January 1976. (ERIC Document Reproduction Service No. ED 134 930, 29p., PC \$3.32, MF \$.83)
- No. 7. Ortony, A. *Names, Descriptions, and Pragmatics*, February 1976. (ERIC Document Reproduction Service No. ED 134 931, 25p., PC \$1.82, MF \$.83)
- No. 8. Mason, J. M. *Questioning the Notion of Independent Processing Stages in Reading*, February 1976. (*Journal of Educational Psychology*, 1977, 69, 288-297)
- No. 9. Siegel, M. A. *Teacher Behaviors and Curriculum Packages: Implications for Research and Teacher Education*, April 1976. (ERIC Document Reproduction Service No. ED 134 932, 42p., PC \$3.32, MF \$.83)
- No. 10. Anderson, R. C., Pichert, J. W., Goetz, E. T., Schallert, D. L., Stevens, K. C., & Trollip, S. R. *Instantiation of General Terms*, March 1976. (ERIC Document Reproduction Service No. ED 134 933, 30p., PC \$3.32, MF \$.83)
- No. 11. Armbruster, B. B. *Learning Principles from Prose: A Cognitive Approach Based on Schema Theory*, July 1976. (ERIC Document Reproduction Service No. ED 134 934, 48p., PC \$3.32, MF \$.83)
- No. 12. Anderson, R. C., Reynolds, R. E., Schallert, D. L., & Goetz, E. T. *Frameworks for Comprehending Discourse*, July 1976. (ERIC Document Reproduction Service No. ED 134 935, 33p., PC \$3.32, MF \$.83)
- No. 13. Rubin, A. D., Bruce, B. C., & Brown, J. S. *A Process-Oriented Language for Describing Aspects of Reading Comprehension*, November 1976. (ERIC Document Reproduction Service No. ED 136 188, 41p., PC \$3.32, MF \$.83)
- No. 14. Pichert, J. W., & Anderson, R. C. *Taking Different Perspectives on a Story*, November 1976. (ERIC Document Reproduction Service No. ED 134 936, 30p., PC \$3.32, MF \$.83)
- No. 15. Schwartz, R. M. *Strategic Processes in Beginning Reading*, November 1976. (ERIC Document Reproduction Service No. ED 134 937, 19p., PC \$1.82, MF \$.83)
- No. 16. Jenkins, J. R., & Pany, D. *Curriculum Biases in Reading Achievement Tests*, November 1976. (ERIC Document Reproduction Service No. ED 134 938, 24p., PC \$1.82, MF \$.83)
- No. 17. Asher, S. R., Hymel, S., & Wigfield, A. *Children's Comprehension of High- and Low-Interest Material and a Comparison of Two Cloze Scoring Methods*, November 1976. (ERIC Document Reproduction Service No. ED 134 939, 32p., PC \$3.32, MF \$.83)
- No. 18. Brown, A. L., Smiley, S. S., Day, J. D., Townsend, M. A. R., & Lawton, S. C. *Intrusion of a Thematic Idea in Children's Comprehension and Retention of Stories*, December 1976. (ERIC Document Reproduction Service No. ED 136 189, 39p., PC \$3.32, MF \$.83)
- No. 19. Kleiman, G. M. *The Prelinguistic Cognitive Basis of Children's Communicative Intentions*, February 1977. (ERIC Document Reproduction Service No. ED 134 940, 51p., PC \$4.82, MF \$.83)
- No. 20. Kleiman, G. M. *The Effect of Previous Context on Reading Individual Words*, February 1977. (ERIC Document Reproduction Service No. ED 134 941, 76p., PC \$6.32, MF \$.83)
- No. 21. Kane, J. H., & Anderson, R. C. *Depth of Processing and Interference Effects in the Learning and Remembering of Sentences*, February 1977. (ERIC Document Reproduction Service No. ED 134 942, 29p., PC \$3.32, MF \$.83)

- No. 22: Brown, A. L., & Campione, J. C. *Memory Strategies in Learning: Training Children to Study Strategically*, March 1977. (ERIC Document Reproduction Service No. ED 136 234, 54p., PC-\$4.82, MF-\$83)
- No. 23: Smiley, S. S., Oakley, D. D., Worthen, D., Campione, J. C., & Brown, A. L. *Recall of Thematically Relevant Material by Adolescent Good and Poor Readers as a Function of Written Versus Oral Presentation*, March 1977. (ERIC Document Reproduction Service No. ED 136 235, 23p., PC-\$1.82, MF-\$83)
- No. 24: Anderson, R. C., Spiro, R. J., & Anderson, M. C. *Schemata as Scaffolding for the Representation of Information in Connected Discourse*, March 1977. (ERIC Document Reproduction Service No. ED 136 236, 18p., PC-\$1.82, MF-\$83)
- No. 25: Pany, D., & Jenkins, J. R. *Learning Word Meanings: A Comparison of Instructional Procedures and Effects on Measures of Reading Comprehension with Learning Disabled Students*, March 1977. (ERIC Document Reproduction Service No. ED 136 237, 34p., PC-\$3.32, MF-\$83)
- No. 26: Armbruster, B. B., Stevens, R. J., & Rosenshine, B. *Analyzing Content Coverage and Emphasis: A Study of Three Curricula and Two Tests*, March 1977. (ERIC Document Reproduction Service No. ED 136 238, 22p., PC-\$1.82, MF-\$83)
- No. 27: Ortony, A., Reynolds, R. E., & Arter, J. A. *Metaphor: Theoretical and Empirical Research*, March 1977. (ERIC Document Reproduction Service No. ED 137 752, 63p., PC-\$4.82, MF-\$83)
- No. 28: Ortony, A. *Remembering and Understanding Jabberwocky and Small-Talk*, March 1977. (ERIC Document Reproduction Service No. ED 137 753, 36p., PC-\$3.32, MF-\$83)
- No. 29: Schallert, D. L., Kleiman, G. M., & Rubin, A. D. *Analysis of Differences between Oral and Written Language*, April 1977. (ERIC Document Reproduction Service No. ED 144 038, 33p., PC-\$3.32, MF-\$83)
- No. 30: Goetz, E. T., & Osborn, J. *Procedures for Sampling Texts and Tasks in Kindergarten through Eighth Grade*, April 1977. (ERIC Document Reproduction Service No. ED 146 565, 80p., PC-\$6.32, MF-\$83)
- No. 31: Nash-Webber, B. *Anaphora: A Cross-Disciplinary Survey*, April 1977. (ERIC Document Reproduction Service No. ED 144 039, 43p., PC-\$3.32, MF-\$83)
- No. 32: Adams, M. J., & Collins, A. *A Schema-Theoretic View of Reading Comprehension*, April 1977. (ERIC Document Reproduction Service No. ED 142 971, 49p., PC-\$3.32, MF-\$83)
- No. 33: Huggins, A. W. F. *Syntactic Aspects of Reading Comprehension*, April 1977. (ERIC Document Reproduction Service No. ED 142 972, 68p., PC-\$4.82, MF-\$83)
- No. 34: Bruce, B. C. *Plans and Social Actions*, April 1977. (ERIC Document Reproduction Service No. ED 149 328, 45p., PC-\$3.32, MF-\$83)
- No. 35: Rubin, A. D. *Comprehension Processes in Oral and Written Language*, April 1977. (ERIC Document Reproduction Service No. ED 150 550, 61p., PC-\$4.82, MF-\$83)
- No. 36: Nash-Webber, B., & Reiter, R. *Anaphora and Logical Form: On Formal Meaning Representation for Natural Language*, April 1977. (ERIC Document Reproduction Service No. ED 142 973, 42p., PC-\$3.32, MF-\$83)
- No. 37: Adams, M. J. *Failures to Comprehend and Levels of Processing in Reading*, April 1977. (ERIC Document Reproduction Service No. ED 145 410, 51p., PC-\$4.82, MF-\$83)
- No. 38: Woods, W. A. *Multiple Theory Formation in High-Level Perception*, April 1977. (ERIC Document Reproduction Service No. ED 144 020, 58p., PC-\$4.82, MF-\$83)
- No. 40: Collins, A., Brown, J. S., & Larkin, K. M. *Inference in Text Understanding*, December 1977. (ERIC Document Reproduction Service No. ED 150 547, 48p., PC-\$3.32, MF-\$83)
- No. 41: Anderson, R. C., & Pichert, J. W. *Recall of Previously Unrecalled Information Following a Shift in Perspective*, April 1977. (ERIC Document Reproduction Service No. ED 142 974, 37p., PC-\$3.32, MF-\$83)
- No. 42: Mason, J., Osborn, J., & Rosenshine, B. *A Consideration of Skill Hierarchy Approaches to the Teaching of Reading*, December 1977. (ERIC Document Reproduction Service No. ED 150 549, 176p., PC-\$12.32, MF-\$83)
- No. 43: Collins, A., Brown, A. L., Morgan, J. L., & Brewer, W. F. *The Analysis of Reading Tasks and Texts*, April 1977. (ERIC Document Reproduction Service No. ED 145 404, 96p., PC-\$6.32, MF-\$83)
- No. 44: McClure, E. *Aspects of Code-Switching in the Discourse of Bilingual Mexican-American Children*, April 1977. (ERIC Document Reproduction Service No. ED 142 975, 38p., PC-\$3.32, MF-\$83)
- No. 45: Schwartz, R. M. *Relation of Context Utilization and Orthographic Automaticity in Word Identification*, May 1977. (ERIC Document Reproduction Service No. ED 137 762, 27p., PC-\$3.32, MF-\$83)

- No. 46: Anderson, R. C., Stevens, K. C., Shiffrin, Z., & Osborn, J. *Instantiation of Word Meanings in Children*, May 1977. (ERIC Document Reproduction Service No. ED 142 976, 22p., PC-\$1.82, MF-\$83)
- No. 47: Brown, A. L. *Knowing When, Where, and How to Remember: A Problem of Metacognition*, June 1977. (ERIC Document Reproduction Service No. ED 146 562, 152p., PC-\$10.82, MF-\$83)
- No. 48: Brown, A. L., & DeLoache, J. S. *Skills, Plans, and Self-Regulation*, July 1977. (ERIC Document Reproduction Service No. ED 144 040, 66p., PC-\$4.82, MF-\$83)
- No. 49: Goetz, E. T. *Inferences in the Comprehension of and Memory for Text*, July 1977. (ERIC Document Reproduction Service No. ED 150 548, 97p., PC-\$6.32, MF-\$83)
- No. 50: Anderson, R. C. *Schema-Directed Processes in Language Comprehension*, July 1977. (ERIC Document Reproduction Service No. ED 142 977, 33p., PC-\$3.32, MF-\$83)
- No. 51: Brown, A. L. *Theories of Memory and the Problems of Development: Activity, Growth, and Knowledge*, July 1977. (ERIC Document Reproduction Service No. ED 144 041, 59p., PC-\$4.82, MF-\$83)
- No. 52: Morgan, J. L. *Two Types of Convention in Indirect Speech Acts*, July 1977. (ERIC Document Reproduction Service No. ED 145 405, 40p., PC-\$3.32, MF-\$83)
- No. 53: Brown, A. L., Smiley, S. S., & Lawton, S. C. *The Effects of Experience on the Selection of Suitable Retrieval Cues for Studying from Prose Passages*, July 1977. (ERIC Document Reproduction Service No. ED 144 042, 30p., PC-\$3.32, MF-\$83)
- No. 54: Fleisher, L. S., & Jenkins, J. R. *Effects of Contextualized and Decontextualized Practice Conditions on Word Recognition*, July 1977. (ERIC Document Reproduction Service No. ED 144 043, 37p., PC-\$3.32, MF-\$83)
- No. 55: Jenkins, J. R., & Larson, K. *Evaluating Error Correction Procedures for Oral Reading*, June 1978. (ERIC Document Reproduction Service No. ED 158 224, 34p., PC-\$3.32, MF-\$83)
- No. 56: Anderson, T. H., Standiford, S. N., & Alessi, S. M. *Computer Assisted Problem Solving in an Introductory Statistics Course*, August 1977. (ERIC Document Reproduction Service No. ED 146 563, 26p., PC-\$3.32, MF-\$83)
- No. 57: Barnitz, J. *Interrelationship of Orthography and Phonological Structure in Learning to Read*, August 1977. (ERIC Document Reproduction Service No. ED 150 546, 62p., PC-\$4.82, MF-\$83)
- No. 58: Mason, J. M. *The Role of Strategy in Reading in the Mentally Retarded*, September 1977. (ERIC Document Reproduction Service No. ED 145 406, 28p., PC-\$3.32, MF-\$83)
- No. 59: Mason, J. M. *Reading Readiness: A Definition and Skills Hierarchy from Preschoolers' Developing Conceptions of Print*, September 1977. (ERIC Document Reproduction Service No. ED 145 403, 57p., PC-\$4.82, MF-\$83)
- No. 60: Spiro, R. J., & Esposito, J. J. *Superficial Processing of Explicit Inferences in Text*, December 1977. (ERIC Document Reproduction Service No. ED 150 545, 27p., PC-\$3.32, MF-\$83)
- No. 65: Brewer, W. F. *Memory for the Pragmatic Implications of Sentences*, October 1977. (ERIC Document Reproduction Service No. ED 146 564, 27p., PC-\$3.32, MF-\$83)
- No. 66: Brown, A. L., & Smiley, S. S. *The Development of Strategies for Study Prose Passages*, October 1977. (ERIC Document Reproduction Service No. ED 145 371, 59p., PC-\$4.82, MF-\$83)
- No. 68: Stein, N. L., & Nezworski, T. *The Effects of Organization and Instructional Set on Story Memory*, January 1978. (ERIC Document Reproduction Service No. ED 149 327, 41p., PC-\$3.32, MF-\$83)
- No. 69: Stein, N. L. *How Children Understand Stories: A Developmental Analysis*, March 1978. (ERIC Document Reproduction Service No. ED 153 205, 68p., PC-\$4.82, MF-\$83)
- No. 76: Thieman, T. J., & Brown, A. L. *The Effects of Semantic and Formal Similarity on Recognition Memory for Sentences in Children*, November 1977. (ERIC Document Reproduction Service No. ED 150 551, 26p., PC-\$3.32, MF-\$83)
- No. 77: Nash-Webber, B. L. *Inferences in an Approach to Discourse Anaphora*, January 1978. (ERIC Document Reproduction Service No. ED 150 552, 30p., PC-\$3.32, MF-\$83)
- No. 78: Gentner, D. *On Relational Meaning: The Acquisition of Verb Meaning*, December 1977. (ERIC Document Reproduction Service No. ED 149 325, 46p., PC-\$3.32, MF-\$83)
- No. 79: Royer, J. M. *Theories of Learning Transfer*, January 1978. (ERIC Document Reproduction Service No. ED 149 326, 55p., PC-\$4.82, MF-\$83)
- No. 80: Arter, J. A., & Jenkins, J. R. *Differential Diagnosis-Prescriptive Teaching: A Critical Appraisal*, January 1978. (ERIC Document Reproduction Service No. ED 150 578, 104p., PC-\$7.82, MF-\$83)
- No. 81: Shoben, E. J. *Choosing a Model of Sentence Picture Comparisons: A Reply to Catlin and Jones*, February 1978. (ERIC Document Reproduction Service No. ED 150 577, 30p., PC-\$3.32, MF-\$83)

- No. 82: Steffensen, M. S. *Bereliter and Engelmann Reconsidered: The Evidence from Children Acquiring Black English Vernacular*, March 1978. (ERIC Document Reproduction Service No. ED 153 204, 31p., PC-\$3.32, MF-\$83)
- No. 83: Reynolds, R. E., Standiford, S. N., & Anderson, R. C. *Distribution of Reading Time When Questions are Asked about a Restricted Category of Text Information*, April 1978. (ERIC Document Reproduction Service No. ED 153 206, 34p., PC-\$3.32, MF-\$83)
- No. 84: Baker, L. *Processing Temporal Relationships in Simple Stories: Effects of Input Sequence*, April 1978. (ERIC Document Reproduction Service No. ED 157 016, 54p., PC-\$4.82, MF-\$83)
- No. 85: Mason, J. M., Knisely, E., & Kendall, J. *Effects of Polysemous Words on Sentence Comprehension*, May 1978. (ERIC Document Reproduction Service No. ED 157 015, 34p., PC-\$3.32, MF-\$83)
- No. 86: Anderson, T. H., Wardrop, J. L., Hively W., Muller, K. E., Anderson, R. I., Hastings, C. N., & Fredericksen, J. *Development and Trial of a Model for Developing Domain Referenced Tests of Reading Comprehension*, May 1978. (ERIC Document Reproduction Service No. ED 157 036, 69p., PC-\$4.82, MF-\$83)
- No. 87: Andre, M. E. D. A., & Anderson, T. H. *The Development and Evaluation of a Self-Questioning Study Technique*, June 1978. (ERIC Document Reproduction Service No. ED 157 037, 37p., PC-\$3.32, MF-\$83)
- No. 88: Bruce, B. C., & Newman, D. *Interacting Plans*, June 1978. (ERIC Document Reproduction Service No. ED 157 038, 100p., PC-\$6.32, MF-\$83)
- No. 89: Bruce, B. C., Collins, A., Rubin, A. D., & Gentner, D. *A Cognitive Science Approach to Writing*, June 1978. (ERIC Document Reproduction Service No. ED 157 039, 57p., PC-\$4.82, MF-\$83)
- No. 90: Asher, S. R. *Referential Communication*, June 1978. (ERIC Document Reproduction Service No. ED 159 597, 71p., PC-\$4.82, MF-\$83)
- No. 91: Royer, J. M., & Cunningham, D. J. *On the Theory and Measurement of Reading Comprehension*, June 1978. (ERIC Document Reproduction Service No. ED 157 040, 63p., PC-\$4.82, MF-\$83)
- No. 92: Mason, J. M., Kendall, J. R. *Facilitating Reading Comprehension Through Text Structure Manipulation*, June 1978. (ERIC Document Reproduction Service No. ED 157 041, 36p., PC-\$3.32, MF-\$83)
- No. 93: Ortony, A., Schallert, D. L., Reynolds, R. E., & Antos, S. J. *Interpreting Metaphors and Idioms: Some Effects of Context on Comprehension*, July 1978. (ERIC Document Reproduction Service No. ED 157 042, 41p., PC-\$3.32, MF-\$83)
- No. 94: Brown, A. L., Campione, J. C., & Barclay, C. R. *Training Self-Checking Routines for Estimating Test Readiness: Generalization from List Learning to Prose Recall*, July 1978. (ERIC Document Reproduction Service No. ED 158 226, 41p., PC-\$3.32, MF-\$83)
- No. 95: Reichman, R. *Conversational Coherency*, July 1978. (ERIC Document Reproduction Service No. ED 159 658, 86p., PC-\$6.32, MF-\$83)
- No. 96: Wigfield, A., & Asher, S. R. *Age Differences in Children's Referential Communication Performance: An Investigation of Task Effects*, July 1978. (ERIC Document Reproduction Service No. ED 159 659, 31p., PC-\$3.32, MF-\$83)
- No. 97: Steffensen, M. S., Jogdeo, C., & Anderson, R. C. *A Cross-Cultural Perspective on Reading Comprehension*, July 1978. (ERIC Document Reproduction Service No. ED 159 660, 41p., PC-\$3.32, MF-\$83)
- No. 98: Green, G. M. *Discourse Functions of Inversion Construction*, July 1978. (ERIC Document Reproduction Service No. ED 160 998, 42p., PC-\$3.32, MF-\$83)
- No. 99: Asher, S. R. *Influence of Topic Interest on Black Children and White Children's Reading Comprehension*, July 1978. (ERIC Document Reproduction Service No. ED 159 661, 35p., PC-\$3.32, MF-\$83)
- No. 100: Jenkins, J. R., Pany, D., & Schreck, J. *Vocabulary and Reading Comprehension: Instructional Effects*, August 1978. (ERIC Document Reproduction Service No. ED 160 999, 50p., PC-\$3.32, MF-\$83)
- No. 101: Shoben, E. J., Rips, L. J., & Smith, E. E. *Issues in Semantic Memory: A Response to Glass and Holyoak*, August 1978. (ERIC Document Reproduction Service No. ED 159 662, 85p., PC-\$6.32, MF-\$83)
- No. 102: Baker, L., & Stein, N. L. *The Development of Prose Comprehension Skills*, September 1978. (ERIC Document Reproduction Service No. ED 159 663, 69p., PC-\$4.82, MF-\$83)
- No. 103: Fleisher, L. S., Jenkins, J. R., & Pany, D. *Effects on Poor Readers' Comprehension of Training in Rapid Decoding*, September 1978. (ERIC Document Reproduction Service No. ED 159 664, 39p., PC-\$3.32, MF-\$83)

- No. 104: Anderson, T. H. *Study Skills and Learning Strategies*, September 1978. (ERIC Document Reproduction Service No. ED 161 000, 41p., PC:\$3.32, MF:\$83)
- No. 105: Ortony, A. *Beyond Literal Similarity*, October 1978. (ERIC Document Reproduction Service No. ED 166 635, 58p., PC:\$4.82, MF:\$83)
- No. 106: Durkin, D. *What Classroom Observations Reveal about Reading Comprehension Instruction*, October 1978. (ERIC Document Reproduction Service No. ED 162 259, 94p., PC:\$6.32, MF:\$83)
- No. 107: Adams, M. J. *Models of Word Recognition*, October 1978. (ERIC Document Reproduction Service No. ED 163 431, 93p., PC:\$6.32, MF:\$83)
- No. 108: Reder, L. M. *Comprehension and Retention of Prose: A Literature Review*, November 1978. (ERIC Document Reproduction Service No. ED 165 114, 116p., PC:\$7.82, MF:\$83)
- No. 109: Wardrop, J. L., Anderson, T. H., Hively, W., Anderson, R. I., Hastings, C. N., & Muller, K. E. *A Framework for Analyzing Reading Test Characteristics*, December 1978. (ERIC Document Reproduction Service No. ED 165 117, 65p., PC:\$4.82, MF:\$83)
- No. 110: Tirre, W. C., Manelis, L., & Leicht, K. L. *The Effects of Imaginal and Verbal Strategies on Prose Comprehension in Adults*, December 1978. (ERIC Document Reproduction Service No. ED 165 116, 27p., PC:\$3.32, MF:\$83)
- No. 111: Spiro, R. J., & Tirre, W. C. *Individual Differences in Schema Utilization During Discourse Processing*, January 1979. (ERIC Document Reproduction Service No. ED 166 651, 29p., PC:\$3.32, MF:\$83)
- No. 112: Ortony, A. *Some Psycholinguistic Aspects of Metaphor*, January 1979. (ERIC Document Reproduction Service No. ED 165 115, 38p., PC:\$3.32, MF:\$83)
- No. 113: Antos, S. J. *Processing Facilitation in a Lexical Decision Task*, January 1979. (ERIC Document Reproduction Service No. ED 165 129, 84p., PC:\$6.32, MF:\$83)
- No. 114: Gentner, D. *Semantic Integration at the Level of Verb Meaning*, February 1979. (ERIC Document Reproduction Service No. ED 165 130, 39p., PC:\$3.32, MF:\$83)
- No. 115: Gearhart, M., & Hall, W. S. *Internal State Words: Cultural and Situational Variation in Vocabulary Usage*, February 1979. (ERIC Document Reproduction Service No. ED 165 131, 66p., PC:\$4.82, MF:\$83)
- No. 116: Pearson, P. D., Hansen, J., & Gordon, C. *The Effect of Background Knowledge on Young Children's Comprehension of Explicit and Implicit Information*, March 1979.
- No. 117: Barnitz, J. G. *Reading Comprehension of Pronoun-Referent Structures by Children in Grades Two, Four, and Six*, March 1979.
- No. 118: Nicholson, T., Pearson, P. D., & Dykstra, R. *Effects of Embedded Anomalies and Oral Reading Errors on Children's Understanding of Stories*, March 1979.
- No. 119: Anderson, R. C., Pichert, J. W., & Shirey, L. L. *Effects of the Reader's Schema at Different Points in Time*, April 1979.
- No. 120: Canney, G., & Winograd, P. *Schemata for Reading and Reading Comprehension Performance*, April 1979.
- No. 121: Hall, W. S., & Guthrie, L. F. *On the Dialect Question and Reading*, May 1979.
- No. 122: McClure, E., Mason, J., & Barnitz, J. *Story Structure and Age Effects on Children's Ability to Sequence Stories*, May 1979.
- No. 123: Kleiman, G. M., Winograd, P. N., & Humphrey, M. M. *Prosody and Children's Parsing of Sentences*, May 1979.
- No. 124: Spiro, R. J. *Etiology of Reading Comprehension Style*, May 1979.
- No. 125: Hall, W. S., & Tirre, W. C. *The Communicative Environment of Young Children: Social Class, Ethnic, and Situational Differences*, May 1979.
- No. 126: Mason, J., & McCormick, C. *Testing the Development of Reading and Linguistic Awareness*, May 1979.
- No. 127: Brown, A. L., & Campione, J. C. *Permissible Inferences from the Outcome of Training Studies in Cognitive Development Research*, May 1979.
- No. 128: Brown, A. L., & French, L. A. *The Zone of Potential Development: Implications for Intelligence Testing in the Year 2000*, May 1979.
- No. 129: Nezworski, T., Stein, N. L., & Trabasso, T. *Story Structure Versus Content Effects on Children's Recall and Evaluative Inferences*, June 1979.
- No. 130: Bruce, B. *Analysis of Interacting Plans as a Guide to the Understanding of Story Structure*, June 1979.

- No. 131: Pearson, P. D., Raphael, T., TePaske, N., & Hyser, C. *The Function of Metaphor in Children's Recall of Expository Passages*, July 1979.
- No. 132: Green, G. M. *Organization, Goals, and Comprehensibility in Narratives: Newswriting, a Case Study*, July 1979.
- No. 133: Kleiman, G. M. *The Scope of Facilitation of Word Recognition from Single Word and Sentence Frame Contexts*, July 1979.
- No. 134: McConkie, G. W., Hogaboam, T. W., Wolverton, G. S., Zola, D., & Lucas, P. A. *Toward the Use of Eye Movements in the Study of Language Processing*, August 1979.
- No. 135: Schwartz, R. M. *Levels of Processing: The Strategic Demands of Reading Comprehension*, August 1979.